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"Can the Defense Technology Industrial Base Meet Surge and Mobilization Requirements?"

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College of the Department of the Navy.

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The Defense Technology Industrial Base (DTIB) is ihn a state of decline. The National Security Strategy rlies heavily on a healthy DTIB to maintain the deterrent capability of the armed forces and to reconstitute those forces in the event of a global war. The ability of the DTIB to fulfill these requirements is limited by a lack of facilities, access to raw materials long-lead times, a shortage of machine tools and most importantly a dwindling labor force. The impact of these factors can be minimized by first recognizing and understanding them and then planning to overcome them. The purpose of this paper is not to identify solutions for the ills of the DTIB but to raise the awareness of the warfighters to the fact that there are serious problems with the DTIB.

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Abstract of
"Can the Defense Technology Industrial Base Meet Surge and Mobilization Requirements?"

The Defense Technology Industrial Base (DTIB) is in a state of decline. The national Security Strategy relies heavily on a healthy DTIB to maintain the deterrent capability of the armed forces and to reconstitute those forces in the event of a global war. The ability of the DTIB to fulfill these requirements is limited by a lack of facilities, access to raw materials, long lead times, a shortage of machine tools and most importantly a dwindling labor force. The impact of these factors can be minimized by first recognizing and understanding them and then planning to overcome them. The purpose of this paper is not to identify solutions for the ills of the DTIB but to raise the awareness of the warfighters to the fact that there are serious problems with the DTIB.

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Chapter I

Introduction

The Problem. The Defense Technology Industrial Base (DTIB) cannot meet the reconstitution requirements called for in the National Security Strategy. However, as the threat of global war decreases and warning time increases the ability of the DTIB to meet demands is greatly enhanced. The question of immediate concern is, "Can the DTIB meet the surge requirements of a regional crisis?" The answer to this question is dependent upon how well the CINC's and service chiefs recognize and understand the factors which impair the ability of the DTIB to respond. These limiting factors are: facilities, materials, machine tools and the labor force.

> " It is clear that the defense industrial base, as it presently exists, is inadequate to a dangerous extent. A steady parade of Department of Defense reports, confirmed in 1980 by a Congressional inquiry, warned that U.S. industry could not expand its production to meet wartime mobilization in less than eighteen months. It is still impossible to surge the output of even the most important weapons and war material much faster than that ".[1]

The number of prime and sub-tier defense contractors is diminishing. Capital investment among defense contractors lags behind that of the commercial sector by as much as fity percent.[2] As defense contractors go out of business an increasing number of vital defense technologies are being bought

up by foreign sources. The DTIB of the 1990s has changed dramatically from that of WWII, but then so has the force structure that the DTIB is required to support. The DTIB has its limitations. How well the CINC's understand these limitations and develop OPLANS to minimize them will decide how effective the DTIB is or can be in supporting the demands of the National Security Strategy. The DTIB should be viewed by the CINC's as a weapon system. Just as warfighters fully understand all the technicalities of high performance aircraft, tanks, ships and munitions so should they be conversant with the capabilities and limitations of the DTIB. The DTIB is a means to achieve the political end in war just like any other weapon system.

Definitions.

Defense Technology Industrial Base. The terms Defense Industrial Base (DIB) and Defense Technology and Industrial Base are synonymous. However, the term DTIB is more descriptive in that it brings attention to both the technological and manufacturing aspects of the industrial base. The term DTIB will be used throughout this paper.

The U.S. Congress, Office of Technology Assessment defines the DTIB as " a combination of people, institutions, technology know-how, and production capacity used to develop and manufacture the weapons and supporting defense equipment needed to achieve our national security objectives ".[3] The DTIB may be divided into three broad components: research and development, production and maintenance, and repair. Together these

components must be capable of developing, producing, and supporting military systems in peacetime and responding to increased military requirements in a crisis or global war.[4] How effective the DTIB is, is dependent on industry's ability to perform these functions and DOD's ability to manage the limitations.

Harold J. Clem in the book Mobilization Preparedness raises the interesting question whether or not the DTIB even exists. He argues that the term DTIB is " often viewed as implying the existence of a structural or organizational homogeneity, and the existence of a more or less dedicated core of the Nation's productive resources. . . . There exists in reality no separate, captive defense industrial base. Rather, one is dealing for the most part here with the complex, dynamic, and interdependent world of the commercial marketplace where anticipated profits are the primary motivating force behind responsiveness and change ".[5] Except for a few Government Owned Contractor Operated (GOCO) facilities there are no industries which report to the Department of Defense. Rather, as Mr. Clem states, they are attracted solely by the profit motif. Short of enacting legislation there is nothing to compel a company to do business with DOD. The point here is that it cannot be turned on and off at will.

Reconstitution. As used in the National Security and National Military Strategies reconstitution means the ability to restore military forces to a level sufficient to prevail in a

global conflict. "Reconstitution involves forming, training, and fielding new fighting units. This includes initially drawing on cadre-type units and laid-up military assets; mobilizing previously trained or new manpower; and activating the industrial base on a large scale. Reconstitution also involves maintaining technology, doctrine, training, experienced military personnel, and innovation necessary to retain the competitive edge in decisive areas of potential military competition."[6]

Surge. "This is a term used to refer to the ability of the defense industry to expand military production in a "peacetime" situation, and without a formal declaration of a national emergency. The term is usually used in the context of a rapid increase in the production of key combat items in response to an emergency falling short of a declared war. Since the elements of surge are operating in a peacetime situation, defense production would be carried on for the most part by existing contractors."[7]

Mobilization. "The rapid expansion of military production to meet material needs in a war fighting situation."[8] It involves the declaration of a national emergency which allows the president to suspend normal legal restrictions and increases his authority to control production and stabilize the economy.[9]

The DTIB and the National Security Strategy. The DTIB plays a vital role in the National Security Strategy of the United States. The emerging strategy places increasing demands on the DTIB and the ability to support the military during all levels of conflict. The primary objective of containing communism has gone

away and our military strategy has shifted from planning for a global conflict to one of crisis response with a regional orientation. This change in strategy requires a change in our approach to the defense industrial base. General Colin Powell, Chairman, Joint Chiefs of Staff stated " We will not retain the forces required for a global conflict. However, we must know what it takes to build up to the necessary levels . . . ".[10] Knowing what it takes means not only identifying the weapon systems, spare parts and consumables required but knowing what the DTIB can and cannot provide.

When the U.S. was confronting the Soviet Union the threat was relatively stable. As the world situation changes and the threat moves from certainty to uncertainty it becomes more difficult to identify what is needed to counter the threat. The risks inherent in this situation can be reduced by a greater awareness by the CINC's and service chiefs as to what the DTIB can and cannot provide and by investing in critical defense and manufacturing technologies that will provide our forces with the technological edge needed to win decisively with minimal casualties and to give industry the flexibility needed to meet the demands of a rapidly changing threat.

Reconstitution is one of four supporting capabilities outlined in the National Military Strategy. As stated by President Bush: " The four fundamental demands of a new era are already clear: to ensure strategic deterrence, to exercise forward presence in key areas, to respond effectively to crises

and to retain the material capacity to reconstitute forces should this ever be needed ".[11] This paper addresses the ability of the DTIB to meet both surge and mobilization requirements.

Besides reconstitution a healthy DTIB enhances the deterrent capability of the U.S. In years past when large armies were the norm the importance of the DTIB was often overlooked. However, as the Base Force is approached the credibility of our deterrent capability will become more dependent on a healthy, responsive DTIB. " The ability to reconstitute is intended to deter a power from militarizing and failing that to provide a global fighting capability ".[12] Of equal importance is maintaining the lead in technology. It is the policy of the United States to use superior technology as a force multiplier. The " advancement in and protection of technology is a national security obligation ".[13] What has changed is our ability to maintain that advantage.

Chapter II

Limitations of the DTIB

The DTIB is in a state of decay. The ability to meet surge and mobilization requirements is doubted by many. Admiral David Jeremiah declared that U.S. industrial capacity " has already declined to the point where domestic capability to support reconstruction may no longer exist."[14] Edward V. Badolato, the Deputy Assistant Secretary for Energy Emergencies, shares the Admirals concern. " In mobilizing for a global war today the U.S. could not accelerate production--not only of guns, tanks and ammunition--but of the defense industrial resource base--as it did in WWII".[15] A study published by the Aerospace Education Foundation in 1988 claims that " the domestic industrial base is losing its capability to meet defense needs even in peacetime".[16] These comments were made before the demise of the Soviet Union. The threat has changed.

As the threat of global war diminishes and warning time increases the ability of the DTIB to meet mobilization requirements also increases. The length of time available to mobilize the DTIB is not only dependent on the amount of warning time given but the U.S. ability to accurately interpret signals and then arouse public opinion to support mobilization. Unfortunately the willingness to mobilize for war is a perceived weakness of a democracy. Mr. Avery R. Kolb described the

attitude of the American people toward industrial mobilization in the book Emergency Resource Management Limited War. " It is basically incompatible with American ideals of people and prosperity, and therefore neglected in normal times . . . ".[17]

The National Military Strategy has shifted the emphasis from global war to regional conflicts. Warning time for this scenario may be weeks or even days. Can the DTIB provide the surge capacity to meet the demands of a regional crisis? The answer is dependent upon the CINC's ability to identify and understand the limitations of the DTIB and develop OPLANS that minimize any adverse impact these limitations may present. Many military leaders do not understand the limitations and capabilities of the DTIB. The post-game analysis for Global Wargame 89 suggests that " many industrial/WRB players had the strong impression that military players' perceived belief is that one could just "turn the supply spigots on".[18] The report further said that " short term military requirement submissions greatly exceeded available production capacity, suggesting a fundamental misunderstanding of present resource constraints on the part of military players".[19] These observations are further supported by the writer's participation in the JLAS-92 wargame held at Maxwell AF Base in April, 1992.

The factors that restrict the ability of the DTIB to meet surge and mobilization requirements can be grouped into four broad categories: facilities, materials, machine tools, and the labor force.

FACILITIES. Declining defense budgets have driven many defense contractors out of business. While adequate capacity exists to meet surge requirements at the prime contractor level excess capacity does not exist at second tier defense contractors. Capital investment among defense contractors is fifty percent less than that of the commercial sector. The cumulative effect of these factors is that facilities and capital equipment dedicated to defense production severely limits the ability of the DTIB to meet demands placed upon it. Eighty-five percent of the U.S. ammunition production capacity is in mothballs. Rather than reactivating these facilities it is cheaper and faster to build new ones. Even then construction time (once funding is provided) will take 18-36 months.[20]

Industry executives agree that production capacity at the prime contractor level exceeds both peacetime production requirements and most expected surge requirements.[21] The problem lies with the second tier contractors who make up seventy percent of the DTIB. At this level the excess capacity does not exist.[22] Second tier contractors who are unable to survive the economic uncertainties of the defense market are leaving the industry in ever increasing numbers. Foreign investors recognize this and have seized the opportunity to acquire technology vital to the nation's defense industry. " Prized U.S. technology and development capabilities, plus reliable toeholds in the U.S. defense market, can be gained easily through acquisitions of companies in need of cash because of shrinking Pentagon

procurement".[23]

The post-game analysis for Global Wargame 89 identified electrical capacity as a " potentially significant constraint on production expansion".[24] It is estimated that lead times to develop additional capacity would exceed twenty four months.[25]

Capital investment within the DTIB lags behind investment in the commercial sector. There are many reasons why this is so. The most often cited are: over regulation, unrealistic specifications and testing requirements, limits on contractor profits, and uncertainty of the defense budget and cumbersome acquisition regulations.[26] The Alcoa Company developed a new aluminum alloy for use in airplanes that saves weight and adds strength. The product is being marketed commercially yet for the reasons cited above Alcoa will not do business with the DOD.[27] The Air Force is interested in procuring a modified commercially available Frequency Agile Signal Simulator available from Hewlitt-Packard. However, DOD regulations require an audit of H-P's books which H-P is unwilling to authorize. Consequently the Air Force must go without.[28]

Manufacturing technology. The ability of the DTIB to meet uncertain requirements with existing facilities can be enhanced by building in manufacturing flexibility. Industrial flexibility was a prime factor in the mobilization success stories of WWII and Korea. Any competitive edge the U.S. has had in manufacturing has been lost. " American management has emphasized design and product innovation to the neglect of

process (manufacturing) technology".[29] While the lack of manufacturing technology does not detract from the technological superiority of U.S. weapon systems it does impact the degree to which the DTIB can respond to changing requirements.

Technology alone will not resolve the limitations that have been discussed. Relying on a process that is not fully understood can lead to serious problems. A case in point is an unpublished paper, written at the Naval War College, entitled " Responsive Industrial Support Exists ". The thesis of the paper is that computer aided design, manufacturing and engineering (CAD/CAM/CAE) " makes factory production so responsive that OPLANS and CONPLANS can include mission specific manufacturing requirements. This technology replaces stockpiling with manufacturing capability and intelligent planning. It is capable of sustaining power projection from the factory instead of the warehouse ".[30] It is true that CAD/CAM/CAE greatly simplifies engineering, identification of spare parts and enhances the production flexibility of a manufacturer. What the paper does not address are the four critical limitations addressed in the previous chapter concerning the DTIB's ability to meet surge and mobilization requirements. CAD/CAM/CAE does nothing to address the imbalance between prime and second tier contractors. This process does nothing to alleviate the U.S. dependency on foreign sources for critical raw materials and component parts. The case study presented in the paper uses the M1A1 tank as an example. It was pointed out in Chapter 2 that this tank is entirely

dependent of foreign micro-chips. Any production surge would be directly proportional to the foreign sources ability and willingness to provide the needed chips. Computer aided systems place a premium on highly trained operators, production workers and design engineers. Where will they come from? Defense contractors are unwilling to invest in a skilled labor force due to the uncertainty of the defense budget. Although CAD/CAM/CAE offers tremendous advantages to industry both in increasing flexibility and decreasing cost it does not provide the CINC an industrial base ready to meet his surge requirements.

In summary there is an imbalance between the capacity available at the prime and second tier contractors. Excess capacity does not exist at the second tier level. This not only limits the ability to meet surge and mobilization requirements but also lengthens the lead times for peace time requirements. Technology can improve responsiveness but cannot by itself overcome the limitations being discussed.

MATERIALS. All the excess capacity in the world is useless if the raw materials and component parts are not readily available. Increased dependence on foreign sources and lengthy leadtimes from both foreign and domestic manufacturers combine to restrict and delay the availability of critical materials and components.

U.S. dependence on foreign sources is increasing.[31] Many hi-tech components contain exotic materials that are not available in the United States. Recognizing the importance of

having these materials available Congress passed the Strategic and Critical Materials Stockpiling Act of 1946. The difficulty lies in predicting how much of which materials to stockpile. In the book Lifeline In Danger: An Assessment of the United States Defense Industrial Base the author states that " the stockpile currently contains many materials of little or no value to actual surge/mobilization needs and substantial overfills of other materials that are relevant". [32]

Besides increasing lead times reliance on foreign sources raises the political question of whether the U.S. will have access to the required raw materials and components. The problem is complicated further because the Pentagon " does not know the extent to which foreign-sourced parts and components are incorporated in the systems it acquires and that there is no reliable system even to identify such dependencies, not to mention systems to minimize them ".[33] Table 1 shows how important foreign sources are to some of our more vital weapon systems.

Table 1

NO CHOICE BUT FOREIGN CHIPS

GLOBAL POSITIONING SYSTEM (satellites)	INTEGRATED UNDERWATER SURVEILLANCE SYSTEM
DEFENSE SATELLITE COMMUNICATION SYSTEM	FLEET SATELLITE COMMUNICATIONS SYSTEM
SSQ AN-53B SONOBUOY	F-16 FIGHTING FALCON
AIM-7 SPARROW AIR-TO-AIR MISSILE	ARMY HELICOPTER IMPROVEMENT PROGRAM (OH-58 Kiowa)
AM-6988 POET DECOY (expendable jammer)	APG-63 AIRBORNE RADAR (for the F-15 Eagle)
M1 ABRAMS TANK	F/A-18 HORNET

Source: Defense Science Board, Report for the Defense Science Task Force on Semiconductor Dependency (Washington, D.C. Office of the Under Secretary of Defense for Acquisition, Feb. 1987), p. 64.

The same factors that restrict the ability of the DTIB as a whole, also impact the provision of piece parts to prime contractors. Table 2 provides average lead times for some critical components. Information of this type is vitally important to the CINC in that it enables him to develop OPLANS that can be realistically supported. It also identifies potential trouble spots that can be subjected to intensive management. For example, during the first week of Desert Storm twenty-five percent of the worldwide stock of Tomahawk missiles were expended.[34] Although the prime contractors, General

Dynamics and McDonnel Douglas, believed that they could double capacity. The CINC must know whether this will be sufficient to meet expenditure rates or will alternative munitions have to be employed. This is an example of recognizing a limitation and planning to overcome it.

TABLE 2

WAITING TIME FOR COMPONENTS
(in months)

ENGINES		WEAPONS		AIRCRAFT	
Fuel controls	24	Actuators	25	Aux. power units	27
Gear boxes	22	Radomes	21	Radar	27
Bearings	23	Traveling Wave tubes	20	Avionics	24
Disks	20	Servos	18	Landing gear	28
Fan blades	19	Microcircuits	18	Wheels&brakes	21
Forgings	13	Harness	18	Nacelles	21
Airfoils	13	Warhead	14	Wings	27
Castings	9	Castings	7	Actuators	21
Pumps	16	Bearings	7	Empennage	29
				Castings	10
				Forgings	15
				Ejection seats	18

Source: Air Force Systems Command

The availability of raw materials and component parts limits the degree to which production capacity may be surged. When reviewing the lessons learned for Desert Storm the procurement success stories must not be overstated. Many companies were able to surge their production to meet military demands on or ahead of schedule. What the literature does not say is how long will the company be able to sustain production? Production may be surged

until all the parts in the system are depleted and then, in the words of General Robert T. Marsh, USAF (RET), comes the big dip, a period of 12-24 months of limited production while the lower tier suppliers and subcontractors surge their own capacity.[35] General Marsh points out another potential problem with supplying component parts. Surge studies only examine one system at a time. " If you're surging AWACS radars and surging Phoenix missiles, we don't know the extent to which they're depending on the same guys for the same critical components".[36]

Identifying alternate sources of material and component parts is beyond the scope of a CINC's responsibilities. However, by being aware of the problem the CINC can minimize any adverse impact. For example, aluminum perchlorate is a critical non-substitutable constituent of propellants used in both space vehicles and PGM's. Peactime production exactly meets peacetime space and PGM production requirements. There is no excess capacity and it will take 12-18 months to develop additional capacity.[37] Knowing this in advance the CINC can place restrictions on the use of PGM's to ensure that production rates can support consumption rates.

MACHINE TOOLING. Machine tools cut, bend, polish and shape raw materials into component parts and end items. The ability to surge production is directly related to the availability of machine tools. The shortage of machine tools was a critical problem during the first and second World Wars, Korea and remains a problem today.[38] Areport published by the Air Force Tactical

Missile Panel in 1984 claims that " industry could not achieve and sustain a fifty percent production rate increase within six months of startup because of deficiencies in input materials, special tooling, and special test equipment"[39].

MANPOWER. When people speak of the defense industrial base one of the first images that comes to mind is the tousands of tanks, guns, airplanes and ships that the United States poduced during WWII. Technology has made huge advances since then. Modern weapon systems are increasingly complex requiring a great deal of skill and knowledge to design and manufacture. Usually extensive training s required. Harry J. Gray, CEO of United Technologies, testfying before the House Armed Services Committee in 1980 said tat during WWII people were hired who had never worked in a factory and were trained in a matter of weeks to build aircraft engines and smaller items.[40] " Currently if takes a machinist apprentice three years to complete his training, and requires the better art of a year to retrain a person from producing automobiles t work on high-technology aeropace parts".[41] Although there is excess capacity in the DTIB, industry executives often cite the lack of skilled manpower as an impediment to any type of surge or mobilization capability.

The shortage of skilled manpower is not limited to production workers but includes engineers and craftsmen as well. The shortage of skilled manpower is not a new issue. It was identified in 1980 in a report of the Defense Industrial Base anel of the House Armed Services Committee as a problem then and

one that was expected to grow worse.[42] Unfortunately this prediction has come true. As defense budgets dwindle and future business becomes increasingly uncertain more and more companies are laying off workers at all levels just to remain competitive. There is a genuine concern in both DOD and defense industries that the DTIB will not be able to attract the engineering talent required to maintain the technological edge.

The lack of experienced engineers not only limits the ability to mobilize but also undermines the deterrent strategy of the United States by reducing the combat effectiveness of fighting forces. It is the policy of the United States to maintain qualitative superiority over potential adversaries in an attempt to offset quantitative superiority.[43] As described in the National Military Strategy technological superiority is pursued to " offset quantitative advantages, to minimize risk to US forces, and to enhance the potential for swift, decisive termination of conflict".[44] Increased reliance on foreign sources for raw materials and component parts limits the ability of the DTIB to meet surge and mobilization requirements. The erosion of U.S. technological superiority in both the defense and civilian sectors exacerbates this problem by further increasing national dependence on foreign sources of supply.

Manpower will be more of a limitation when attempting to surge the DTIB to meet the demands of a regional crisis than for mobilizing for a global war due to the greatly reduced warning time. Reduced warning time means less time to recruit and train

a labor force. If Desert Storm is to be the norm, the DTIB must be able to surge with existing manpower.

Identifying Requirements. Planning to contain the Soviet union was a relatively simple task when compared to planning for a regional crisis against an uncertain threat. In this scenario the CINC's must identify through the JCS those critical technologies that can be employed in a multitude of environments without sacrificing the combat effectiveness of employed troops.

Any attempt to overcome the limitations of the DTIB is entirely dependent on a strong industry-military relationship. Industry must know what DOD requires and when. DOD, in particular the CINC's, must know what industry can provide and in what timeframe. The perception among industry executives is that the " government doesn't know what it really wants and when it wants it".[45] The military, on the other hand, does not have a firm understanding of what industry can provide. To complicate things further both parties have difficulty communicating their needs to the other party. During Global Wargame 89 it was noted that the " perspectives as well as the language employed by industry and the military differ tremendously ".[46]

To understand what the DTIB can provide, government agencies have developed databases and models to collect and analyze data. JCS uses the Joint Industrial Mobilization Planning Process (JIMPP), FEMA uses Resolution of Capacity Shortfalls (ROCS) and OSD employs the Defense Industrial Network (DINET). The drawbacks of these systems are: development and data collection

efforts are not coordinated, data collection is underfunded, and data collection concerning subtier contractors has been neglected.[47] It is no mystery why military planners are uncertain about the capabilities of the DTIB.

Despite the problems and limitations discussed the service chiefs are still responsible for providing the equipment and supplies needed by the CINC to implement the National Military Strategy. How well the service chiefs meet these demands is to a large extent dependent on their knowledge of the DTIB. Understanding what industry can and cannot provide is the key. Both the CINC and service chiefs must know and understand the limitations and take action to overcome them. During Desert Storm a shortage of Army T-rations became a problem. Industry was not able to surge production and war reserve MRE's and commercial substitutes were used. The fact that production of T-rations could not be surged should have been known in advance. Although a commercial substitute was available it was not, but should have been, a planned option. Knowing what the limitations are and developing plans to overcome them reduces the risk of an OPLAN not being logistically supportable.

Second, industry and DOD officials must work closely together to identify and prioritize critical materials and technologies needed to support peacetime operations, surge and mobilization requirements. " It will be imperative for the military to know quickly what it needs to have produced first should the nation face a national emergency ".[48]

Finally the CINC's and Service Chiefs must be willing to fund those critical items that will be needed to sustain the combat effectiveness of employed troops. Accomplishing this will require a major change in organization culture. " While military planners express a preference for readiness over force size, in the only vote that counts-the service planning documents-they continue to prefer funding major weapon systems even at the expense of readiness ".[49]

Chapter III

Conclusions

The effectiveness of the DTIB is reduced due to a lack of understanding by military officials of the factors that limit the surge and mobilization capacity of the DTIB. This paper has discussed four of the key limiting factors. Through an understanding of these limitations warfighters can develop OPLANS that are logistically supportable given the existing industrial base.

The four limiting factors are: facilities, materials, machine tools and the labor force.

Facilities. Surge and mobilization capacity is limted by a lack of capacity at second tier contractors. Adequate capacity exists at the prime contractor level but not at the second tier level. Production equipment and facilities are aging with little or no incentive for capital investment. The uncertainty of future defense budgets continues to force second tier contractors out of business, thus the gap between the prime and second tier contractors continues to widen.

Materials. U.S. dependence on foreign sources for raw materials and compponent parts continues to increase. Whether of not the U.S. will have acess to these items in a crisis is a question that must be considered. Even in peacetime lead times for many critical items are lengthy. As the number of contractors and suppliers decrease lead tlimes will continue to increase.

Machine tools. The shortage of machine tools has historically been and continues to be a constraint. Without machine tools raw materials cannot be processed.

Labor force. Of all the limiting factors the most critical is the shortage of skilled engineers, craftsmen and production workers. The training process for these individuals is lengthy. Failure to maintain a skilled workforce not only diminishes the surge and mobilization capacity but threatens the technological superiority upon which warfighters are dependent.

The DOD and civilian agencies need to develop a standardized DTIB database. This database must provide information that will enable planners to identify in advance what lead times will be, what items will be able to be surged, and identify commercially available substitutes. This information will allow planners to pursue alternative courses of action such as increasing war reserve stocks, developing alternate technologies or keeping a critical production line open.

Military requirements for surge and mobilization must be clearly identified, prioritized and communicated to industry. Industry representatives must play an active part in the planning process. They are the ones who know best what they can and cannot do.

The DTIB cannot meet the requirements for reconstitution and depending on DOD's ability to recognize and understand the limitations can only marginally meet surge requirements. Increasing the awareness of the warfighters will help to overcome this shortfall.

NOTES

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